

## REMARKS

### Introductory Comments

The present application includes claims 12-18 and 45-57. Claim 57 is amended as shown in the listing of the claims. With this response, claims 12-18 and 45-57 continue to be pending in the present application. Continued examination of the application, in view of amendments and the following remarks is respectfully requested.

### Claim Objections

Claim 15 was objected to with the comment: “it appears that the language of claim 15 repeats the limitation, ‘first plurality of spaced-apart regions.’” Applicant submits that claim 15 recites:

The device of claim 12, wherein each of the first plurality of spaced-apart regions is separated from another of the first plurality of spaced-apart regions by one of a second plurality of regions configured to not bind the first analyte

As shown above, “first plurality of spaced-apart regions” appears twice (see underlined phrases) but the first occurrence refers to “each of the first plurality of spaced-apart regions” and the second occurrence refers to “another of the first plurality of spaced-apart regions.” Thus, Applicant submits that this is not a repeat of the same limitation but rather references to different members of the “first plurality of spaced-apart regions.” Applicant respectfully requests that this objection be withdrawn.

### **Claim Rejections – 35 USC § 102(b)**

Claims 12-14, 18 and 53-57 were rejected under 35 USC § 102(b) as being anticipated by U.S. Patent 5,900,935 to Klein et al. (“Klein”).

Klein discloses a homodyne interferometer which is described as follows in col. 3, line 39 to col. 4, line 30 and Figures 1 and 2 of Klein. A laser beam 14 is directed to a beamsplitter 18 which divides the beam 14 into a reference beam 20 passing through the beamsplitter 18 and into a probe beam 24 directed toward a workpiece 26 to be examined. The workpiece 26 is vibrated ultrasonically by a pulsed laser 30. The probe beam 24 is reflected or scattered by the surface 28 of the ultrasonically vibrated workpiece 26 as a return signal beam 32 traveling back along its incident path. The vibration, displacement and rough surface 28 of the workpiece 26 impart phase perturbations and spatial wavefront distortions on the return signal beam 32. The return signal beam 32 and the reference beam 20 are directed to a holographic element 38. The difference in the path length of reference beam 20 and the signal beam 32 between the beamsplitter 18 and the receiving surface of the holographic element 36 should be less than the coherence length of the laser generator. The return signal beam 32 is combined with the reference beam 20 in the holographic element 36 which results in two output beams 40, 44. The beam 40 is directed to a photodetector 46.

Independent claim 12 recites:

    a substrate including a first plurality of spaced-apart regions configured to bind the first analyte;

    an optical source configured to generate a probe beam which illuminates the first plurality of spaced-apart regions in a sequential manner and interacts with the substrate to form a signal beam;

an interferometer configured to combine with an adaptive optical element  
a reference beam and the signal beam, the combination of the reference beam  
and the signal beam generating an output beam; and  
a detector configured to detect the presence or absence of the first analyte  
based upon the output beam.

Applicant respectfully submits that many of the limitations of claim 12 are not disclosed in Klein. The Examiner compares the workpiece 26 with the substrate of claim 12 (Office Action, page 3, paragraph 7). However, the workpiece 26 of Klein does not include “a first plurality of spaced-apart regions configured to bind the first analyte.” Klein does not disclose binding of an analyte or spaced-apart regions as recited in claim 12. In addition, Klein does not disclose “a probe beam which illuminates the first plurality of spaced-apart regions in a sequential manner.” The workpiece 26 in Klein which is illuminated by laser beam 14 is vibrated by a pulse laser 30, but there is no disclosure of illumination “in a sequential manner” as recited in claim 12.

For at least these reasons, Applicant believes claim 12 is not anticipated by Klein. Claims 13, 14, 18 and 53-57 depend on base claim 12. Accordingly, Applicant respectfully requests that this rejection be withdrawn and that claims 12-14, 18 and 53-57 be found allowable.

Claim 14, which is dependent on claim 12, recites “wherein the probe beam is transmitted through the substrate to form the signal beam.” In Klein, the laser beam 14 generated by laser source 10 is scattered or reflected by the workpiece 26. The pulsed laser beam 31 generated by source 30 is used to vibrate the workpiece 26. However, neither of the laser beams of Klein “is transmitted through the substrate to form the signal beam” as recited in claim 14. For at least

these reasons, in addition to reasons given above with regard to base claim 12, Applicant believes claim 14 is not anticipated by Klein. Accordingly, Applicant respectfully requests that this rejection be withdrawn and that claim 14 be found allowable.

Claim 54, which is dependent on claim 12, recites “the substrate includes a first surface lying substantially in a first plane and a second surface lying substantially in a second plane, the first plane being offset vertically from the second plane, each of the first plurality of regions lying on the first surface.” The Examiner compares the workpiece 26 with the substrate of claim 12 (Office Action, page 3, paragraph 7). Klein does not disclose a substrate that “includes a first surface lying substantially in a first plane and a second surface lying substantially in a second plane, the first plane being offset vertically from the second plane” as recited in claim 54. For at least these reasons, in addition to reasons given above with regard to base claim 12, Applicant believes claim 54 is not anticipated by Klein. Claims 55-57 depend on intermediate claim 54 and base claim 12. Accordingly, Applicant respectfully requests that this rejection be withdrawn and that claims 54-57 be found allowable.

Claim 55, which is dependent on base claim 12 and intermediate claim 54, recites:

a first portion of the probe beam interacts with a target portion of the first surface holding one of the first plurality of regions, and a second portion of the probe beam interacts with a portion of the second surface adjacent to the target portion of the first surface, the first and second portions of the probe beam being combined to produce the output beam, the output beam having a first form when the first analyte is not bound to the target portion of the first

surface and a second form when the first analyte is bound to the target portion of the first surface.

Intermediate claim 54 recites that “the substrate includes a first surface lying substantially in a first plane and a second surface lying substantially in a second plane, the first plane being offset vertically from the second plane, each of the first plurality of regions lying on the first surface.”

Klein does not disclose “a first portion of the probe beam interact[ing] with a target portion of the first surface ... and a second portion of the probe beam interact[ing] with a portion of the second surface adjacent to the target portion of the first surface” with the “first surface lying substantially in a first plane and [the] second surface lying substantially in a second plane, the first plane being offset vertically from the second plane” (claim 54). Klein does not disclose surfaces in different planes that are offset vertically, nor does it disclose a probe beam that interacts with “a target portion of the first surface” and “a portion of the second surface adjacent to the target portion of the first surface” as recited in claim 55.

In addition, Klein does not disclose “the first and second portions of the probe beam being combined to produce the output beam, the output beam having a first form when the first analyte is not bound to the target portion of the first surface and a second form when the first analyte is bound to the target portion of the first surface” as recited in claim 55. The reference beam 20 in Klein does not interact with the workpiece 26; only the return beam 32 interacts with the workpiece 26. In contrast, claim 55 recites “the first and second portions of the probe beam being combined to produce the output beam” where both the first and second portions of the probe beam interact with the substrate.

For at least these reasons, in addition to reasons given above with regard to base claim 12 and intermediate claim 54, Applicant believes claim 55 is not anticipated by Klein. Claims 56

and 57 depend on intermediate claims 54, 55 and on base claim 12. Accordingly, Applicant respectfully requests that this rejection be withdrawn and that claims 55-57 be found allowable.

Claim 56, which is dependent on base claim 12 and intermediate claims 54 and 55, recites “the output beam includes the first portion of the probe beam reflected from the substrate and the second portion of the probe beam reflected from the substrate.” Klein does not disclose an “output beam [that] includes the first portion of the probe beam reflected from the substrate and the second portion of the probe beam reflected from the substrate” as recited in claim 56, where “a first portion of the probe beam interacts with a target portion of the first surface holding one of the first plurality of regions, and a second portion of the probe beam interacts with a portion of the second surface adjacent to the target portion of the first surface” (claim 55). The reference beam 20 in Klein does not interact with the workpiece 26; only the return beam 32 interacts with the workpiece 26. For at least these reasons, in addition to reasons given above with regard to base claim 12 and intermediate claims 54 and 55, Applicant believes claim 56 is not anticipated by Klein. Accordingly, Applicant respectfully requests that this rejection be withdrawn and that claim 56 be found allowable.

Claim 57, which is dependent on base claim 12 and intermediate claims 54 and 55, recites “the output beam includes the first portion of the probe beam transmitted through the substrate and the second portion of the probe beam transmitted through the substrate.” In Klein, the laser beam 14 generated by laser source 10 is scattered or reflected by the workpiece 26, and the pulsed laser beam 31 generated by source 30 is used to vibrate the workpiece 26. Klein does not disclose any “beam transmitted through the substrate” as recited in claim 57. For at least

these reasons, in addition to reasons given above with regard to base claim 12 and intermediate claims 54 and 55, Applicant believes claim 57 is not anticipated by Klein. Accordingly, Applicant respectfully requests that this rejection be withdrawn and that claim 57 be found allowable.

#### **Claim Rejections – 35 USC § 103(a)**

Claims 15-17 and 45-52 were rejected under 35 USC § 103(a) as being unpatentable over Klein in view of U.S. Patent 5,478,750 to Bernstein et al. (“Bernstein”).

The Examiner asserts that it would have been obvious to combine the teachings of Klein and Bernstein. However, Klein teaches uses of a laser source 10, whereas Bernstein teaches use of “white light (comprising a continuum of wavelengths) from an arc lamp 45 ... Use of an arc lamp is highly advantageous in an analyzer of this size.” (Bernstein, col. 4, lines 5-9). In addition, Bernstein discloses “a series of detector assemblies 60. Each detector assembly 60 comprises a beam splitter 62, an interference filter 64, and a photodetector 66” (Bernstein, col. 4, lines 40-42; see also Figure 3). This series of detector assemblies breaks down the white light into different wavebands for each of the series of detector assemblies. Thus, Bernstein teaches away from use of a laser, since a laser would make all but one of the detector assemblies of Bernstein superfluous; and the multi-wavelength white light system required by Bernstein would not work with the laser system of Klein. In addition, Klein teaches vibration of the workpiece 26 using a pulse laser 30, whereas Bernstein teaches rotation of the sample to cause mixing. There is no mixing in Klein, nor is their vibration in Bernstein. Thus, Applicant submits it would not be obvious to combine the teachings of Bernstein with the teachings of Klein.

Claim 15, which is dependent on claim 12, recites “each of the first plurality of spaced-apart regions is separated from another of the first plurality of spaced-apart regions by one of a second plurality of regions configured to not bind the first analyte.” As the Examiner notes, Klein does not disclose a substrate having a second plurality of regions (Office Action, page 5, paragraph 11). Bernstein discloses a series of consecutive assay cuvettes 33 which contain reagent and a separate series of consecutive reference cuvettes 35 without reagent (see Bernstein Fig. 2 and col. 3, lines 30-38). Neither Bernstein nor Klein, alone or in combination, disclose “each of [a] first plurality of spaced-apart regions ... separated from another of the first plurality of spaced-apart regions by one of a second plurality of regions configured to not bind the first analyte” as recited in claim 15. For at least these reasons, in addition to reasons given above with regard to base claim 12, Applicant believes claim 15 is patentable over Klein and Bernstein. Claims 45-52 depend on claim 15. Accordingly, Applicant respectfully requests that this rejection be withdrawn and that claims 15 and 45-52 be found allowable.

Claim 16, which is dependent on claim 12, recites “the substrate includes a plurality of concentric tracks spaced such that the probe beam illuminates a single track, the first plurality of spaced-apart regions being disposed on the plurality of concentric tracks.” As the Examiner notes, Klein does not disclose a substrate having concentric tracks (Office Action, page 5, paragraph 11). Bernstein discloses a rotor 20 having one outer track with assay cuvettes 33 and reference cuvettes 35 that are illuminated by the light from the arc lamp 45 (see Bernstein Figs. 2, 3 and 5). Neither Bernstein nor Klein, alone or in combination, disclose a substrate that “includes a plurality of concentric tracks spaced such that the probe beam illuminates a single track” as recited in claim 16. In addition, neither Bernstein nor Klein, alone or in combination,



disclose “the first plurality of spaced-apart regions being disposed on the plurality of concentric tracks” as recited in claim 16, where the “first plurality of spaced-apart regions [are] configured to bind the first analyte” (claim 12). For at least these reasons, in addition to reasons given above with regard to base claim 12, Applicant believes claim 16 is patentable over Klein and Bernstein. Claim 17 depends on claim 16. Accordingly, Applicant respectfully requests that this rejection be withdrawn and that claims 16 and 17 be found allowable.

Claim 17, which is dependent on base claim 12 and intermediate claim 16, recites “a controller configured to control on which track of the plurality of tracks the probe beam is incident.” As the Examiner notes, Klein does not disclose a substrate having concentric tracks (Office Action, page 5, paragraph 11). Bernstein discloses a rotor 20 having one outer track with assay cuvettes 33 and reference cuvettes 35 that are illuminated by the light from the arc lamp 45 (see Bernstein Figs. 2, 3 and 5). Neither Bernstein nor Klein, alone or in combination, disclose “a controller configured to control on which track of the plurality of tracks the probe beam is incident” as recited in claim 17. Bernstein has no need for such a controller since the rotor 20 only has one track. For at least these reasons, in addition to reasons given above with regard to claims 12 and 16, Applicant believes claim 17 is patentable over Klein and Bernstein. Accordingly, Applicant respectfully requests that this rejection be withdrawn and that claim 17 be found allowable.

Claim 45, which is dependent on base claim 12 and intermediate claim 15, recites several limitations including “the detector indicates the presence of the analyte based on an interference characteristic of the output beam, the output beam having a first interference characteristic if the

first analyte is bound to the substrate and a second interference characteristic if the first analyte is not bound to the substrate.” Neither Klein nor Bernstein discloses an analyte bound to a substrate. In Klein, there is no indication that an analyte or any other material is bound to the workpiece 26 which is illuminated using the laser beam. In Bernstein, “As the rotor spins inside the analyzer, the blood sample mixes to homogeneity with the diluent. ... [The] assay cuvettes hold specially formulated reagent beads. The reagent beads dissolve in the plasma and chemical reactions are initiated between components of the diluted plasma and the reagent beads.” (Bernstein, col. 3, lines 22-34). There is no disclosure of an analyte bound to the substrate creating an interference characteristic as recited in claim 45. For at least these reasons, in addition to reasons given above with regard to claims 12 and 15, Applicant believes claim 45 is patentable over Klein and Bernstein. Claims 46-52 depend on claim 45. Accordingly, Applicant respectfully requests that this rejection be withdrawn and that claims 45-52 be found allowable.

Claim 46, which is dependent on base claim 12 and intermediate claims 15 and 45, recites “each of the first plurality of regions and the second plurality of regions are arranged in an alternating pattern, such that the first plurality of regions and the second plurality of regions form circular tracks on the substrate.” As the Examiner notes, Klein does not disclose a substrate having a second plurality of regions and concentric tracks (Office Action, page 5, paragraph 11). Bernstein discloses a series of consecutive assay cuvettes 33 which contain reagent and a separate series of consecutive reference cuvettes 35 without reagent (see Bernstein Fig. 2 and col. 3, lines 30-38). Neither Bernstein nor Klein, alone or in combination, disclose “each of the first plurality of regions and the second plurality of regions are arranged in an alternating pattern” as recited in claim 46. In addition, Bernstein discloses a rotor 20 having one outer track

with assay cuvettes 33 and reference cuvettes 35 that are illuminated by the light from the arc lamp 45 (see Bernstein Figs. 2, 3 and 5). Neither Bernstein nor Klein, alone or in combination, disclose a substrate with “the first plurality of regions and the second plurality of regions form circular tracks on the substrate” as recited in claim 46. For at least these reasons, in addition to reasons given above with regard to claims 12, 15 and 45, Applicant believes claim 46 is patentable over Klein and Bernstein. Accordingly, Applicant respectfully requests that this rejection be withdrawn and that claim 46 be found allowable.

Claim 47, which is dependent on base claim 12 and intermediate claims 15 and 45, recites “each of the first plurality of regions and the second plurality of regions are arranged in an alternating pattern, such that the first plurality of regions and the second plurality of regions form radially extending spokes on the substrate.” As the Examiner notes, Klein does not disclose a substrate having a second plurality of regions and concentric tracks (Office Action, page 5, paragraph 11). Bernstein discloses a series of consecutive assay cuvettes 33 which contain reagent and a separate series of consecutive reference cuvettes 35 without reagent (see Bernstein Fig. 2 and col. 3, lines 30-38). Neither Bernstein nor Klein, alone or in combination, disclose “each of the first plurality of regions and the second plurality of regions are arranged in an alternating pattern” as recited in claim 47. In addition, Bernstein discloses a rotor 20 having one outer track with assay cuvettes 33 and reference cuvettes 35 that are illuminated by the light from the arc lamp 45 (see Bernstein Figs. 2, 3 and 5). Neither Bernstein nor Klein, alone or in combination, disclose a substrate where “the first plurality of regions and the second plurality of regions form radially extending spokes on the substrate” as recited in claim 47. For at least these reasons, in addition to reasons given above with regard to claims 12, 15 and 45, Applicant

believes claim 47 is patentable over Klein and Bernstein. Claim 48 depends on claim 47. Accordingly, Applicant respectfully requests that this rejection be withdrawn and that claims 47 and 48 be found allowable.

Claim 48, which is dependent on base claim 12 and intermediate claims 15, 45 and 47, recites “the first plurality of regions and the second plurality of regions are formed on the substrate by microfluidic printing.” Klein discloses a workpiece 46 with no indication of microfluidic printing. Bernstein discloses mixing blood to homogeneity with a diluent, and dissolving reagent beads in the plasma. Neither Bernstein nor Klein, alone or in combination, disclose a “first plurality of regions and [a] second plurality of regions ... formed on the substrate by microfluidic printing” as recited in claim 48. For at least these reasons, in addition to reasons given above with regard to claims 12, 15, 45 and 47, Applicant believes claim 48 is patentable over Klein and Bernstein. Accordingly, Applicant respectfully requests that this rejection be withdrawn and that claim 48 be found allowable.

Claim 49, which is dependent on base claim 12 and intermediate claims 15 and 45, recites “the substrate includes a plurality of circular concentric tracks, each track including at least one of the first plurality of regions and at least one of the second plurality of regions, the first plurality of regions and the second plurality of regions being arranged in a repeating pattern.” As the Examiner notes, Klein does not disclose a substrate having a second plurality of regions and concentric tracks (Office Action, page 5, paragraph 11). Bernstein discloses a series of consecutive assay cuvettes 33 which contain reagent and a separate series of consecutive reference cuvettes 35 without reagent (see Bernstein Fig. 2 and col. 3, lines 30-38). Neither

Bernstien nor Klein, alone or in combination, discloses a substrate that “includes a plurality of circular concentric tracks” as recited in claim 49; nor “each track including at least one of the first plurality of regions and at least one of the second plurality of regions ... arranged in a repeating pattern” as recited in claim 49. For at least these reasons, in addition to reasons given above with regard to claims 12, 15 and 45, Applicant believes claim 49 is patentable over Klein and Bernstein. Accordingly, Applicant respectfully requests that this rejection be withdrawn and that claim 49 be found allowable.

Claim 50, which is dependent on base claim 12 and intermediate claims 15 and 45, recites “the first plurality of regions has a first height and the second plurality of regions has a second height, the second height being offset relative to the first height.” As the Examiner notes, Klein does not disclose a substrate having a second plurality of regions (Office Action, page 5, paragraph 11). Bernstein discloses a mixing and dissolving of fluids in cuvettes (see Bernstein Fig. 2 and col. 3, lines 22-38). Neither Bernstien nor Klein, alone or in combination, discloses a substrate where “the first plurality of regions has a first height and the second plurality of regions has a second height, the second height being offset relative to the first height” as recited in claim 50. For at least these reasons, in addition to reasons given above with regard to claims 12, 15 and 45, Applicant believes claim 50 is patentable over Klein and Bernstein. Claims 51 and 52 depend on claim 50. Accordingly, Applicant respectfully requests that this rejection be withdrawn and that claims 50-52 be found allowable.

Claim 51, which is dependent on base claim 12 and intermediate claims 15, 45 and 50, recites “the second height is offset relative to the first height by approximately one-eighth of a

wavelength of the beam,” and claim 50 recites “the first plurality of regions has a first height and the second plurality of regions has a second height.” As the Examiner notes, Klein does not disclose a substrate having a second plurality of regions (Office Action, page 5, paragraph 11). Bernstein discloses a mixing and dissolving of fluids in cuvettes (see Bernstein Fig. 2 and col. 3, lines 22-38). Neither Bernstein nor Klein, alone or in combination, discloses a substrate where “the first plurality of regions has a first height and the second plurality of regions has a second height” where the “the second height is offset relative to the first height by approximately one-eighth of a wavelength of the beam” as recited in claim 51. For at least these reasons, in addition to reasons given above with regard to claims 12, 15, 45 and 50, Applicant believes claim 51 is patentable over Klein and Bernstein. Accordingly, Applicant respectfully requests that this rejection be withdrawn and that claim 51 be found allowable.

Claim 52, which is dependent on base claim 12 and intermediate claims 15, 45 and 50, recites “the second height is offset relative to the first height by approximately one-fourth of a wavelength of the beam,” and claim 50 recites “the first plurality of regions has a first height and the second plurality of regions has a second height.” As the Examiner notes, Klein does not disclose a substrate having a second plurality of regions (Office Action, page 5, paragraph 11). Bernstein discloses a mixing and dissolving of fluids in cuvettes (see Bernstein Fig. 2 and col. 3, lines 22-38). Neither Bernstein nor Klein, alone or in combination, discloses a substrate where “the first plurality of regions has a first height and the second plurality of regions has a second height” where the “the second height is offset relative to the first height by approximately one-fourth of a wavelength of the beam” as recited in claim 52. For at least these reasons, in addition to reasons given above with regard to claims 12, 15, 45 and 50, Applicant believes claim 52 is

patentable over Klein and Bernstein. Accordingly, Applicant respectfully requests that this rejection be withdrawn and that claim 52 be found allowable.

**Final Remarks**

Claims 12-18 and 45-57 are pending in the present application and are believed to be in condition for allowance. Such allowance is respectfully requested.

In the event that there are any questions related to this amendment or to the application in general, the undersigned would appreciate the opportunity to address those questions directly in a telephone interview at 919-861-5092 to expedite the prosecution of this application for all concerned. If necessary, please consider this a Petition for Extension of Time to affect a timely response. Please charge any additional fees or credits to the account of Bose McKinney & Evans, LLP Deposit Account No. 02-3223.

Respectfully submitted,  
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